

## BRIEFER ARTICLES.

### SOME PECULIARITIES IN PUCCINIA TELEUTOSPORES.<sup>1</sup>

(WITH SIX FIGURES)

THE distinguishing characteristics of many Puccinia teleutospores are very slight, while on the other hand such species as *P. podophylli*, *coronata*, *pruni*, etc., are, in typical specimens, at once set aside from all others by the markings of their epispores. In many species, variations in the number and position of the septa are characteristic. Generally, however, the shape and size of the spores are fairly constant, and this is particularly true of *P. graminis* Pers. and allied gramineous rusts. Occasionally one-celled spores are found, due perhaps, as Professor Burrill<sup>2</sup> suggests, to insufficient nutrition. Eriksson and Henning<sup>3</sup> call attention to the so-called mesospores and other peculiarities found among spores from closed sori of *P. graminis*, attributing them to the pressure of the epidermis, and Bolley<sup>4</sup> in regard to the anomalous shapes found among spores says "certain it is that pressure within the crowded sorus is capable of producing an almost unlimited number of irregularities in the spore forms." J. A. Warren<sup>5</sup> has written regarding some very striking variations in the spores of *P. Windsoriae* Schw., while Dietel,<sup>6</sup> writing on peculiarities in Puccinia spores, refers to the finding of a well-developed four-celled spore of *P. graminis*, and from time to time the odd shapes of rust spores have been noted by various writers.

*Puccinia heterospora* B. & C. is a species showing many interesting variations, giving as they do an indication of the close relationship of

<sup>1</sup> Contribution from Botanical Dept. Iowa State College of Agriculture and Mechanic Arts, no. 16.

<sup>2</sup> Parasitic fungi of Illinois I: 171. 1885.

<sup>3</sup> Die Getreideroste 129. pl. 4.

<sup>4</sup> Sub-epidermal rusts. BOT. GAZ. 14: 139-144. pl. 15. Je. 1889.

<sup>5</sup> Notes on the variations of *Puccinia Windsoriae*, Am. Nat. 32: 779-781. pl. 1. 1898.

<sup>6</sup> Beiträge zur Morphologie und Biologie der Uredineen. Bot. Centralblatt 32: 86-88. 1887.

the *Uromyces* and *Puccinia* genera of the Uredineæ; in fact, this species must be regarded as one of the connecting links between the two. The spores are of two kinds, one and two-celled, the one-celled being globose to subglobose, and measuring  $19 \times 28\mu$ .

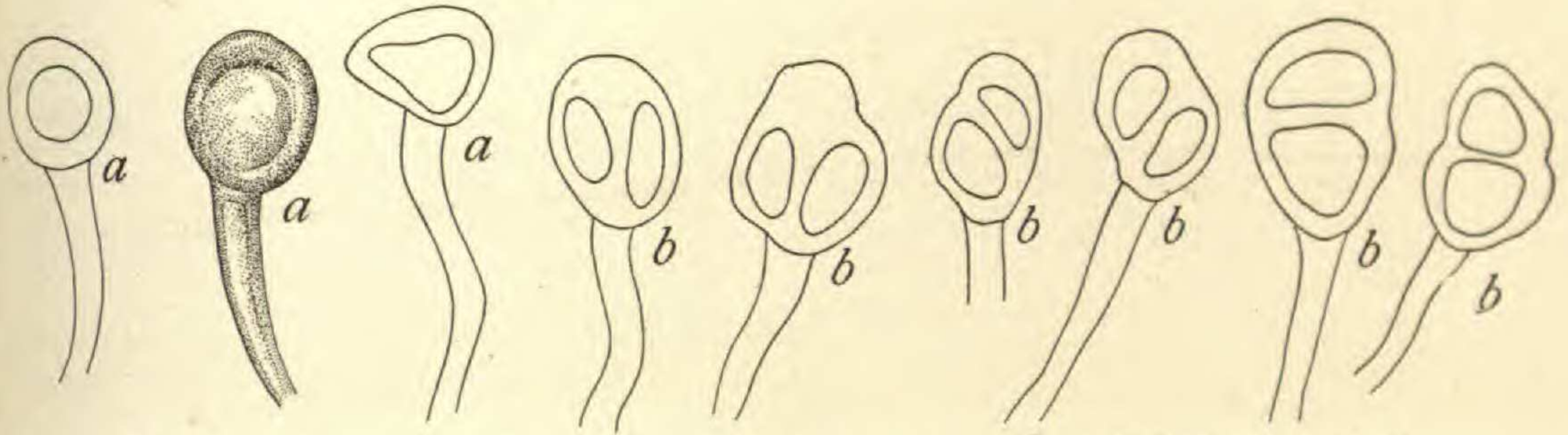


FIG. 1.—Teleutospores of *Puccinia heterospora*. *a*, one-celled; *b*, two-celled.

The two-celled spores are of three kinds: some have the septum transverse, in some it is oblique, while in others it coincides with the axis of the spore. The measurements do not differ materially from those given for the one-celled spores. The one-celled forms are much more numerous and the epispores of all are thick and smooth.

In 1884, Dr. Trelease<sup>7</sup> described a species occurring on *Bromus ciliatus* and called it *P. tomipara*. He says, "this species is remarkable



FIG. 2.—Teleutospores of *Puccinia tomipara*. *a*, one-celled; *b*, two-celled; *c*, three-celled; *d*, four-celled.

from the fact that the spores are commonly three or four-celled with the uppermost septum oblique or not infrequently parallel to the axis of the spore, which is thus made to consist of more than one row of cells." To this comment on the very variable spores of this species nothing can be added.

*Puccinia irregularis* E. & T. is another species showing variable teleutospores, one, two, and three-celled spores being found. The

<sup>7</sup> Preliminary list of parasitic fungi of Wisconsin 22-23. N. 1884.

septa are always transverse. In addition to the variation in the number of cells, the spores are peculiar because of the position of strongly developed papillae. Usually a single papilla is found at the apex of the spore, but often the spores are truncate, when two papillae appear,

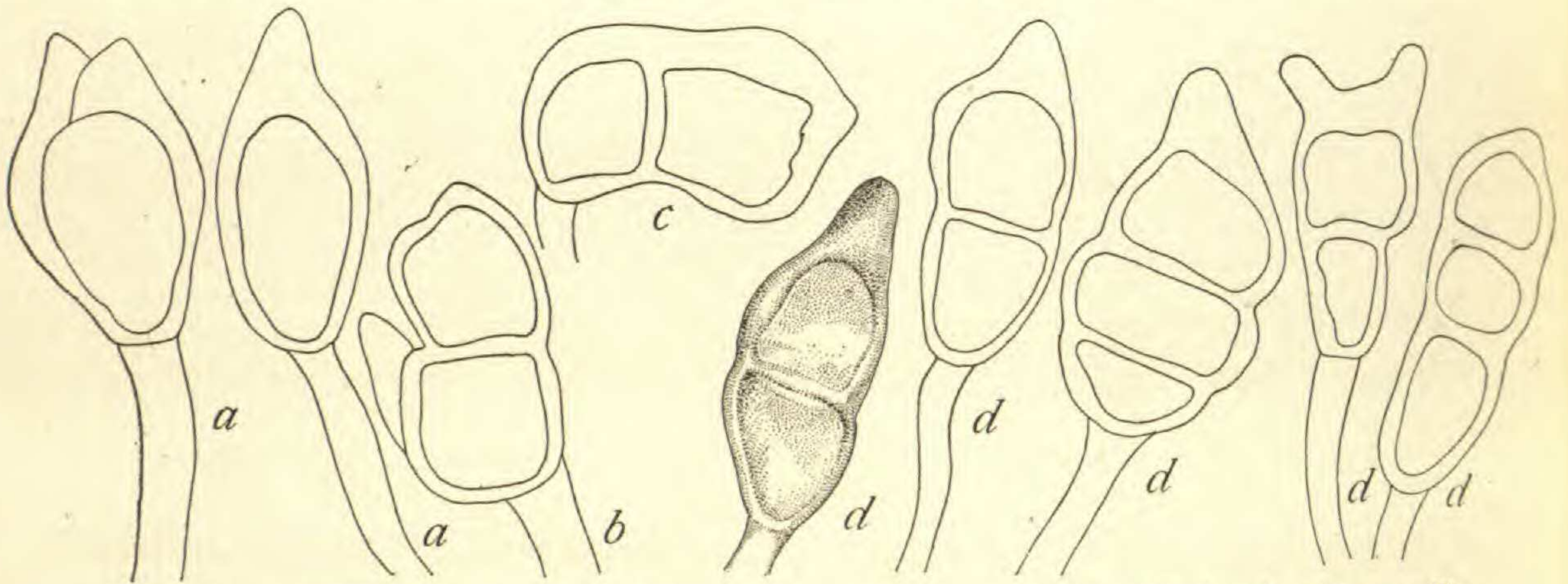


FIG. 3.—Teleutospores of *Puccinia irregularis*. *a*, one-celled; *b*, with papilla below septum; *c*, with side thickening; *d*, two- and three-celled.

one on each side. In some the papilla is found just below the septum. One spore was observed having the whole of one side thickened instead of the apex. The spores measure  $50-75 \times 19-28\mu$ , the one-celled spores being somewhat smaller.

An examination of the material in the herbaria of the Missouri Botanical Garden and the Iowa State College leads to the belief that this is undoubtedly the species referred to *P. Solidaginis* Pk. by Dr. Trelease, no. 169, *Preliminary list of parasitic fungi of Wisconsin*.

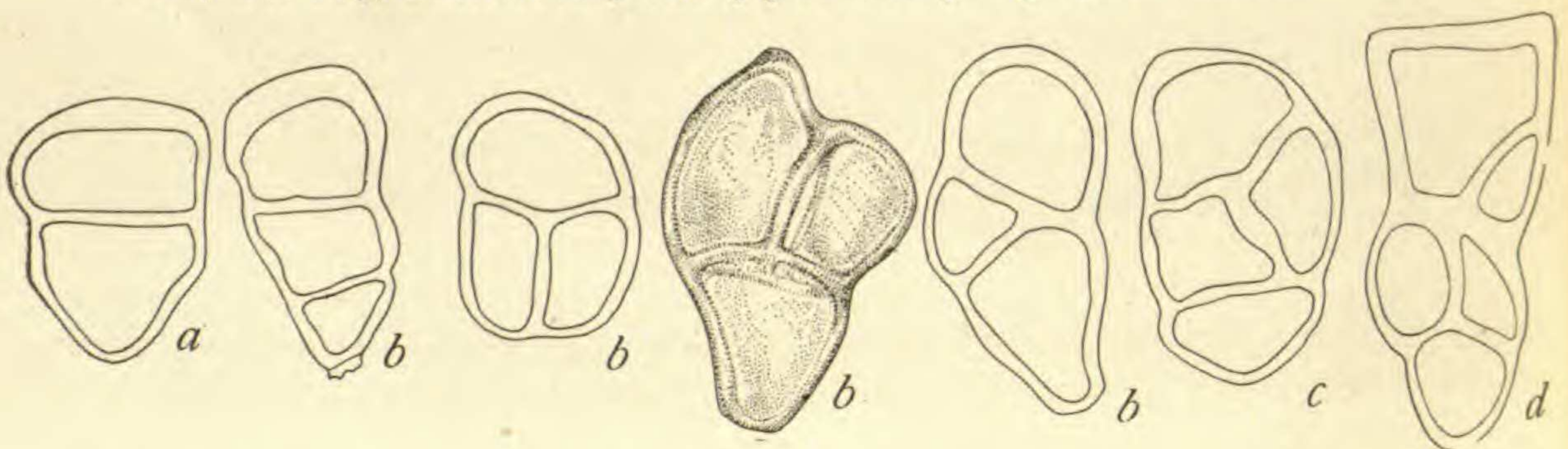


FIG. 4.—Teleutospores of *Puccinia Montanensis*. *a*, normal; *b*, three-celled; *c*, four-celled; *d*, five-celled.

A specimen of *Puccinia* occurring on *Elymus robustus* was collected at Ames, Iowa, by G. W. Carver, October 14, 1895. The greater number of the spores were quite normal in shape and just what might

be expected in a Puccinia, but among them were found a few spores of more than two cells. The multicellular spores were in some cases not unlike those of *P. triarticulata* B. & C., but owing to their scarcity and the fact that the two-celled spores agree in size and shape with those

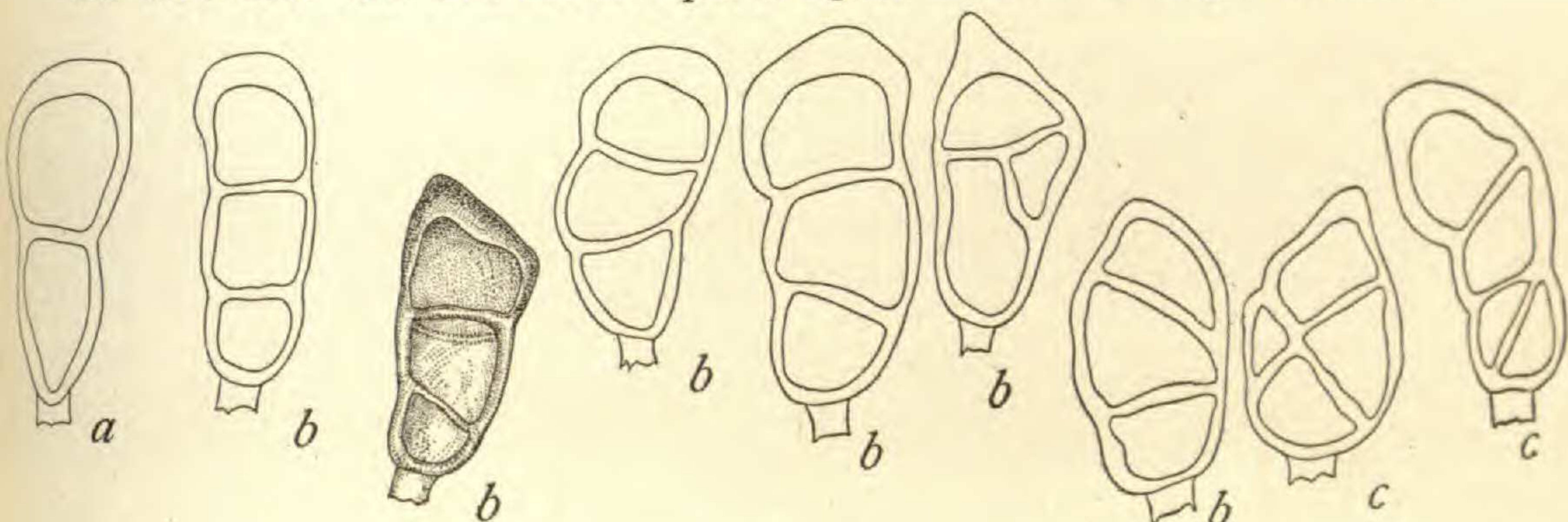


FIG. 5.—Teleutospores of *Puccinia Rubigo-vera*. a, normal; b, three-celled; c, four-celled.

of *P. Montanensis* Ell. it is best to regard it as that species. The position of the septa in some of the spores would be very hard to describe. Some spores were quite regularly three and four-celled, while in others oblique, transverse, and perpendicular septa were present, all in one spore. The three-celled forms were of two kinds, regular ones, and those in which two cells were found at the apex with one at the base, but occasionally this was just reversed. The measurements varied from  $33 \times 25\mu$  to  $55 \times 33\mu$ .

A specimen of *Puccinia Rubigo-vera* (DC.) Wint. on *Agropyron tenerum*, collected at Ames in 1896, showed a considerable number of spores having three and four cells. The normal two-celled spores were greatly in excess of the others, being found in the proportion of about fifty to one. The three-celled forms were usually somewhat irregular, though occasionally one was found in which the septa crossed the spore at the right angles to the lateral walls. The four-celled forms were fewer in number than the three-celled, only a half dozen being found in three mounts. The septa were so placed as to divide the spore in different planes. The measurements of all were confined within the usual limits for this species,  $13-20 \times 28-56\mu$ .

On November 24, 1898, the writer picked up a piece of rust-affected oat straw (*Avena sativa* L.) on the road in front of the dairy building at the Iowa State College. The rust sori presented all the features of the sori of *P. graminis* Pers., appearing on the sheath as black linear or oval confluent patches.

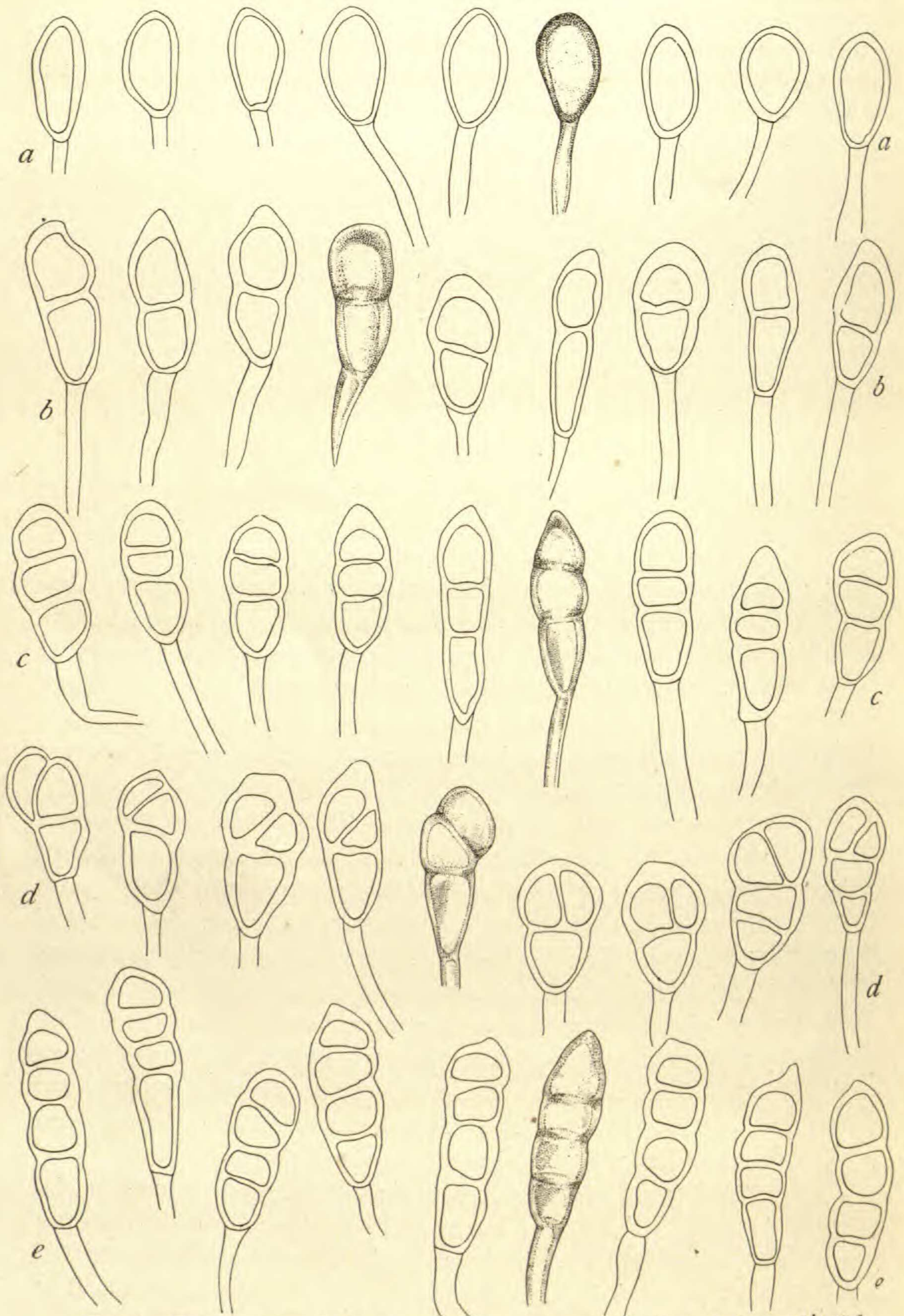


FIG. 6.—Teleutospores of *Puccinia graminis*. *a-a*, one-celled; *b-b*, normal; *c-c*, three-celled, septum horizontal; *d-d*, three- and four-celled, septum oblique; *e-e*, four-celled, septum horizontal.

A microscopical examination made sometime afterward revealed some noteworthy peculiarities in the shape, size, and number of cells in the teleutospores. The usual two-celled spores were present but accompanied by others having one, three, and four cells.

The different forms were about equal in number but differed considerably in size, the four-celled variety being the largest, as one would naturally expect. Of each form ten measurements were made, giving the following extremes: one-celled,  $27-36 \times 15-20\mu$ ; two-celled,  $30-45 \times 15-21\mu$ ; three-celled,  $45-54 \times 15-21\mu$ ; four-celled,  $52-66 \times 15-20\mu$ .

The one-celled spores might easily have passed for the teleutospores of some *Uromyces* such as *U. graminicola* Burrill. The two-celled ones were quite normal in size and shape, except that in some the pedicels were much stouter than are usually found in *P. graminis*, more closely resembling the pedicels of *P. emaculata* Schw. The three and four-celled forms were of three kinds, some having the upper septum horizontal, some oblique, and others vertical, as though the upper cell had been formed as a sort of afterthought, by the division of the second or third cell as the case might be.

In these the evolutionary development of several genera of Uredinae could be plainly traced, passing from the lower *Uromyces* through *Puccinia* and *Triphragmium* to *Phragmidium*. The spores, aside from the number of cells, were not likely to be mistaken for those of *Triphragmium* or *Phragmidium*, as they were quite different in general appearance. These genera have undoubtedly a common origin, and must be looked upon as being more highly developed, more specialized, in direct relation to the number of cells in the spores, as it is quite apparent that a larger number of sporidia can be produced with less effort in those having the larger number of divisions in the spores.—H. HAROLD HUME, *Iowa State College, Ames.*

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#### WHAT IS PRUNUS INSITITIA?

IN the June number of the *BOTANICAL GAZETTE* there appeared an article under the heading given above and written by Professor F. A. Waugh. The conclusion to which the author arrives, in his own words, is "that there is no such species as *Prunus insititia*."

To me this seems rather strange. I happen to have been born in the land of Linnæus and received a large portion of my botanical